adopted for most impulse turbines. It has already been explained that the moving blades of impulse turbines are generally mounted on the periphery of separate discs which are threaded on to the shaft. If the same method of construction were adopted in a reaction turbine, the drop in pressure across the individual discs would cause a heavy and varying axial bending load on the discs which would be very undesirable, and this applies particularly at the high-pressure end. It is therefore customary to enlarge the diameter of the shaft within the turbine housing to approximately that required for the roots of the blades, and to mount the blades in grooves cut into the periphery of the shaft.

The diaphragms used in impulse turbines are replaced in reaction turbines by a series of blade rings fixed in grooves cut into the body of the casing.

Impulse-reaction Turbines.—Where one or more stages of a turbine are built on the impulse principle and the remainder on the reaction principle they are known as impulse-reaction turbines. In practice such turbines are built with one impulse stage consisting of a nozzle plate and velocity wheel at the high-pressure end, the intermediate- and low-pressure stages being of the Parsons reaction type,

General Description.—Some early turbine designs, notably the earlier Curtis turbines, were built with a vertical axis, but practically all modern turbines are built with horizontal axes.

Owing to the increasing specific volume of the steam with falling pressure, the blade and nozzle areas and consequently the blade lengths increase with succeeding stages.

The Ljungstrom turbine is the most successful example of the radial-flow type, that is to say, the steam enters around the centre of the turbine and passes radially through expansion stages to the periphery. The majority of turbines are of the parallel-flow type, in which the steam paths are substantially parallel to the axis.

Most steam turbines consist in the main of a casing or body, split horizontally, and a rotor or shaft together with the necessary bearings, bedplate, governor gear, oil-pump, and a thrust block to prevent axial movement. In reaction turbines the unbalanced axial pressure

across the areas of the blades and shaft exposed to the steam calls for the use of dummy pistons or balance pistons to counteract the resultant end thrust.

In impulse turbines the unbalanced axial forces are sufficiently small to be dealt with by a thrust block of ordinary pattern.

In some of the latest turbines of the reaction type, the balance pistons have been avoided by the use of thrust blocks of the Michell type, which are capable of handling the very heavy thrust without assuming unreasonable proportions or introducing severe friction losses.

In reaction turbines the fixed blades are let into the body of the casing. In impulse machines the first batch of nozzles is usually formed into one or two ring segments, bolted to the inside of the casing at the high-pressure end, which is then formed into a circular steam passage resembling the letter C in section, with the nozzle plate bolted across the gap.